

CLAIMS

1. Data processing means for calculating an estimated time of arrival of a seismic or microseismic P or S wave at a sensor station, comprising a data processor adapted to:
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- a) calculate an estimated time of origin for the seismic or microseismic event generating the P and S waves, based on a P to S wave velocity ratio and picked arrival times of the P and S waves at a sensor station other than the one for which the estimated time of arrival of the P or S wave is to be calculated; and
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- b) calculate the estimated time of arrival of the P or S wave, based on a P to S wave velocity ratio, the estimated time of origin of the event and, where the estimated arrival time of a P wave is to be calculated, a picked arrival time of the S wave at the sensor station for which the estimated arrival time of the P wave is being calculated or, where the estimated arrival time of a S wave is to be calculated, a picked arrival time of the P wave at the sensor station for which the estimated arrival time of the S wave is to be calculated.
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2. Data processing means according to claim 1, said data processor being adapted to calculate estimated arrival times for both the P and S waves at a sensor station.
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3. Data processing means according to claim 1 or 2, said data processor being adapted to calculate a plurality of estimated times of arrival of the P and/or S wave at a sensor station, based on a plurality of estimated times of origin for the microseismic event calculated from the picked arrival times of the P and S waves at a plurality of sensor stations other than the one at which the estimated times of arrival are to be calculated.
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4. Data processing means according to claim 3, wherein the data processor is further adapted to display the picked arrival times and estimated arrival times in relation to each other such that the clustering pattern of the arrival times can be analysed.
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5. Data processing means according to claim 4, wherein the data processor is adapted to display information regarding the calculation of any particular estimated arrival time in response to the selection of said estimated arrival time by an user.
- 5 6. Data processing means according to any preceding claim, said data processor being adapted to calculate one or more estimated times of arrival for the P and/or S waves at each sensor station in a network of sensor stations, wherein for each sensor station the necessary estimated time or times of origin are calculated from the
- 10 picked arrival times of the P and S waves at one or more of the other stations in said network.
7. Data processing means according to any preceding claim, wherein the data processor is adapted to receive seismic data from the sensor stations and to pick arrival times for the P and S wave at each sensor station based on said seismic data.
- 15 8. Data processing means according to any preceding claim, wherein, where a number of possible arrival times for a wave at a sensor station could be picked, the data processor is adapted to compare said possible arrival times with any estimates
- 20 calculated for the arrival time of said wave at said station in order to determine which of the possible picked arrival times are more likely to correspond to the true arrival time of said wave at said station.
9. Data processing means according to claim 8, wherein the data processor is further adapted to select or modify one of said possible arrival times in order to arrive at a final picked arrival time that, based on said determination, seems most like to correspond to the true arrival time of said wave.
- 25 10. Data processing means according to claim 8, wherein the data processor is adapted to indicate which of the possible arrival times should be selected or modified in
- 30 order to arrive at a final picked arrival time that seems, based on said determination, to be most likely to correspond with the true arrival time.

11. A data carrier comprising computer readable program means for adapting a computer to function as the data processing means of any one of claims 1 to 10.
12. A method of calculating an estimated time of arrival of a seismic or microseismic P or S wave at a sensor station, said method comprising the steps of:
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- a) calculating an estimated time of origin for the seismic or microseismic event generating the P and S waves, based on a P to S wave velocity ratio and picked arrival times of the P and S waves at a sensor station other than the one for which the estimated time of arrival of the P or S wave is to be calculated; and
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- b) calculating the estimated time of arrival of the P or S wave, based on a P to S wave velocity ratio, the estimated time of origin of the event and, where the estimated arrival time of a P wave is to be calculated, a picked arrival time of the S wave at the sensor station for which the estimated arrival time of the P wave is being calculated or, where the estimated arrival time of a S wave is to be calculated, a picked arrival time of the P wave at the sensor station for which the estimated arrival time of the S wave is to be calculated.
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